

**MEMORANDUM:**

**DATE:** 4 September 1998

**SUBJECT:** CTWG HAPs vs. Criteria Pollutants Report

**FROM:** Combustion Turbine Work Group

**TO:** ICCR Coordinating Committee

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The Combustion Turbine Work Group (CTWG) formed a task group to examine the relationship between HAPs and criteria pollutants, identify turbine factors that directly affect HAP emissions, and investigate options for regulatory development. The task group was comprised of one EPA representative and members of the turbine user community. The attached document describes the activities of this task group and summarizes their conclusions.

The CTWG concurs that this information may be valuable to EPA in developing regulations for combustion turbines and requests that the ICCR Coordinating Committee pass it to EPA as a Work in Progress Item.

Attachment: Summary of HAPs vs. Criteria Pollutants Task Group

## **Summary of HAPs vs. Criteria Pollutants Task Group**

The HAPs vs. Criteria Pollutants Task Group was formed at the March 1997 Combustion Turbine Work Group meeting in Chicago, IL. Charles Chang was named the task group leader and A.J. Cherian, Greg Adams, Sims Roy, and Derek Furstenwerth were named as members. The main responsibilities of the task group were: 1) to identify the relationship of HAPs vs. criteria pollutant emissions, 2) to identify the turbine factors (operational and design) which directly affect HAP emissions, and 3) to investigate options for regulatory development.

Charles Chang conducted a presentation at the April 1997 CTWG meeting in San Francisco, CA, in which he provided a detailed discussion of a set of questions related to criteria pollutants, HAP pollutants, identification of the relationship of HAP vs. criteria pollutants, identification of turbine factors (operational and design) which directly affect HAP emissions, and the identification of potential surrogates for HAPs. He presented several graphs obtained from reciprocating internal combustion engines which reflected the relationship of criteria (specifically CO and VOC) emissions with respect to air to fuel (A/F) ratio for natural gas-fired engines. The objectives were to understand the emissions formation process and identify factors which may affect emissions levels. He indicated that the main product of the task group will be documentation for turbines similar to the ones available for reciprocating internal combustion engines.

At the May 1997 CTWG meeting in Durham, NC, the task group reported limited progress since its last meeting. The task group reported that they had been unable to find a graphical representation of emissions vs. A/F ratio for combustion turbines. Charles Chang reported that he would discuss methods for controlling air to fuel ratio with turbine manufacturers and that he would also attempt to identify research studies conducted on potential emissions resulting from varying of turbine operating conditions, such as A/F ratio, load, and combustor type.

Charles Chang reported at the July 1997 CTWG meeting in Long Beach, CA, that no data had been gathered on the HAP vs. criteria emissions issue. He indicated that he expected that some information would be presented during the Turbines Technology Workshop which would provide the task group with some leads; however, very limited information was provided. The following documents were distributed to task group members for their review:

1. Schorr, Marvin M. "NO<sub>x</sub> Emission Control for Gas Turbines: A 1991 Update on Regulations and Technology (Part II)," Turbomachinery International, Nov/Dec 1991, pp. 28-36.
2. Ten-page fax from A.J. Cherian to Charles Chang dated May 12, 1997, with information from Rolls Royce on air to fuel ratios.
3. Summary of Water Injection Testing at Houston Lighting & Power's T.H. Wharton Station, from Derek Furstenwerth to Charles Chang, dated July 8, 1997.
4. Prade, Bernd and Streb, Holger. "Development and Test Results of the Hybrid-Burner Ring Combustor of the Model V84.3A Gas Turbine"

5. Hung, Wilfred S.Y. "Predictive Emission Monitoring System (PEMS): The Established NO<sub>x</sub> Monitoring System for Industrial Gas Turbines"

There was no report from the task group at the September 1997 CTWG meeting in Durham, NC. Task group members were asked to review distributed documents in preparation for an upcoming teleconference.

The task group held a teleconference on November 13, 1997. The group discussed the limited data available on HAPs vs. NO<sub>x</sub>. The group felt strongly that NO<sub>x</sub> control by steam or water injection causes an increase in formaldehyde; however, there is little or no data to support this. Greg Adams indicated that he was aware of one data point taken at different times for one turbine without water injection and with water injection and the formaldehyde emissions were much higher when water injection was being used. However, he acknowledged that the tests were not done within the same timeframe. The task group indicated an interest in investigating this matter further because very little data are available. It was pointed out that trying to tackle the water/steam injection issue would be difficult since most of the existing turbines rely on this technique to reduce NO<sub>x</sub> emissions. State and local groups would have to find another way to control NO<sub>x</sub> and would have to revise their permits. One group member stated that the resolution of the dichotomy between lower NO<sub>x</sub> required by NSPS and new source review and a possible increase in air toxics (Section 112) was their sole reason for participating in the ICCR.

The group found that CO is a good indicator of combustion conditions, but no trend could be identified relating CO to specific HAPs. The group agreed that although low CO appears to correspond to good combustion conditions and low HAPs, high CO does not necessarily mean high HAPs. Therefore, it was decided that CO may not be a reliable surrogate for specific HAPs.

Members of the group suggested that non-criteria pollutants, such as ammonia and carbon dioxide, should also be considered with respect to HAPs. After some discussion the HAPs vs. CO<sub>2</sub> issue was dismissed as being too large an issue to address at this time and beyond the scope of the task group's work. It was pointed out that ammonia could lead to the formation of fine particulate after it is in the atmosphere. With respect to ammonia, Sims Roy pointed out that neither ammonia nor fine particulate were HAP's under the CAA but their effects could be considered as secondary pollutant impacts when determining environmental impacts for various regulatory options.

The CTWG test plan being considered by the CTWG will measure HAP's and criteria pollutants simultaneously and that could provide some information to assess the HAP vs criteria pollutant issue.

Charles Chang resigned as chair of the task group and from the CTWG at the November meeting since his employer was downsizing. The task group decided not to appoint a new chairperson because the task group has gone as far as it can in analyzing this issue at this time. The group decided that meetings will be called on an ad hoc basis in the future if needed. Trade-off issues that arise when developing MACT will be discussed at that time.